Smolt and yearling outmigrations... Continued

Beach seining and other measures to reduce predator density are being evaluated at Clifton Court Forebay.

Regular removal of striped bass from the secondary screen channels at the Tracy Facility should continue until a more permanent solution is found.

k. Reduce indirect smolt mortality caused by the State and Federal Water Projects in the San Joaquin Delta.

Mitigation agreements are now in place to offset the direct loss of some fish species and the State and Federal water export facilities. Negotiations between Department of Water Resources and Department of Fish and Game have been underway for some time in an attempt to mitigate the indirect losses associated with the State project operations. Recently negotiations (South Delta Water Management Alternatives Project and Article VII of the Delta Pumping Plant Agreement) have accelerated. Resolution of the various project-related problems may be beyond the scope and time frame of this Plan. However, SJRMP Advisory Council encourages the parties to evaluate and implement interim mitigation features that rely on "real-time" knowledge of fish movements, guidance structures (e.g., Old River Barrier) and coordinated basin-wide water operations (Delta and tributaries) to reduce the indirect impacts of these projects on-site if at all possible.

l. Evaluate "trap and truck" or other measures to avoid high mortality of salmon juveniles and smolts.

This approach has not been used extensively in California. Research on the Columbia River system dating back to the 1970's suggests that there may be value in this approach for smolts. It requires substantial capital and staffing. Department of Fish and Game has trapped newly emergent fry and successfully reared them at the Merced and Tuolumne River rearing facilities in the past. This has been a small scale operation thus far. The concept is to recover young fish at a time or location before major mortality occurs and to transport or in some way release the salvaged fish back into the system in a manner that results in increased production of adult fish. There may be merit in exploring this action item if most others fail.

5. **Genetic maintenance** The homing behavior of Pacific salmon and the late migrations of fall-run salmon into the San Joaquin drainage tend to restrict gene flow between other fall-runs in the Central Valley. Balancing this geographic and temporal separation is the natural tendency for salmon to stray. Genetic studies in California suggest that there is high gene flow between salmon populations in the Central Valley. Some believe this may be a symptom resulting from the transportation of large numbers of hatchery fish from the Sacramento River drainage downstream to the estuary resulting in higher straying rates when these fish return.

Very few tagged fish from hatcheries in the Sacramento River system have been recovered during spawning escapement surveys in the San Joaquin drainage. This may be due to significant differences in water quality and the difference in timing of upstream migrations. Also, there has been very limited transplanting of eggs and young salmon into the San Joaquin drainage from non-natal streams. In the late 1960's eyed salmon eggs from the American River were buried in the spawning gravels two years, and sac-fry (alevins) were released into the San Joaquin tributaries only one year. Due to the sensitivity of these early life stages and the lack of response in subsequent runs, it does not appear these plants produced many adult fish.

The genetic research work completed to date identified that (1) coastal and Central Valley Chinook salmon in California appear to be genetically differentiated by drainage and river system (allozyme analysis), (2) there is a high level of gene flow between Central Valley salmon runs, (3) although gene flow between populations may be high they may still be differentiated (by measures such as genetic distances, allele frequencies, unique alleles, etc.), and (4) monitoring and preservation of the variability and diversity of existing genetic resources should be strongly encouraged.

The following actions, and probably combinations of these, should be considered for inclusion into existing and future management activities in the San Joaquin drainage:

a. Use a "gene bank" (cryogenic preservation) to ensure the protection of San Joaquin fall-run salmon genetic material in the event of a catastrophic loss.

   We are relatively unfamiliar with this technique but recognize that it has been used to preserve Atlantic salmon genetic material. It probably warrants a thorough review in advance of catastrophic losses.

b. Selective harvest of hatchery fish.

   Refer to 1.c. above.

Genetic maintenance... Continued

c. Use natural fish in captive breeding programs.

Monitor the Winter-run program now underway at Bodega Bay Marine Laboratory and the Steinhardt Aquarium where young fish will be held in captivity until reaching adulthood to become captive broodstock. There are a number of other approaches that rely on either hatchery or wild gametes or juveniles reared in ocean net pens or isolated fresh water facilities, which are then brought back to their natal stream so their offspring imprint on their natal drainage. There are steelhead enthusiasts and people interested in restoring native runs who have adopted similar programs making them appear fairly cost effective. Again we are relatively unfamiliar with the results and recommend a thorough review before adopting this as a primary strategy.

d. Complete genetic differentiation studies in the San Joaquin tributaries and monitor appropriate indicators through time to help preserve genetic variability and diversity.

Research completed to date does not conclusively separate, nor does it combine, the San Joaquin fall-run with runs elsewhere in the Central Valley. Genetically these fish were most closely grouped with the fall-runs in the American and Feather Rivers (dendrograms). The Department of Fish and Game has continued to manage the stock as a discrete unit from stocks outside the drainage.

Due to the long history of trapping and outplanting young from within the San Joaquin drainage and then planting the offspring in all three tributaries, unique genetics between fish from the three tributaries seems unlikely. Genetic evaluations using mitochondrial DNA polymer chain reaction products for electrophoretic analysis are underway elsewhere in California and may be quite valuable in this drainage. This and other techniques could be used to determine if San Joaquin stock may be differentiated from other fall-runs in the Central Valley. They have been differentiated from fall-runs in the north coast rivers.

e. Establish a genetic advisory committee using the knowledge and resources of academia and management experts.

Current research results and management techniques useful in developing genetic maintenance strategies

Genetic maintenance... Continued

should be monitored on a regular basis. An Advisory Committee could (a) review the impacts of hatchery release strategies, (b) examine operations at Merced River Fish Facility and associated operations, (c) identify fish culture techniques influencing the genetic make-up, (d) propose possible mating strategies to minimize the potential effect of crossing limited adults. In combination these efforts could help insure the San Joaquin stock can adapt to future habitat changes and continue as a discrete population.